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ABSTRACT

The purpose of this study was to determine whether a teacher's involvement in a National Science Foundation Summer Institute Program designed to increase his content competencies would alter his perception of self and subject and subsequently alter his students' views of science and education as a whole. Thirty-two teachers participating in a 1971 summer program (Group I) and thirty teachers participating in a 1972 summer session (Group II) were studied. The Student Semantic Differential, Teacher Semantic Differential, Annual Self-Inventory for Science Teachers, and Teacher Concern Statement were taken on both groups of teachers prior to their participation in the institute: after the first year following the institute; and for Group I teachers, after the second year following the institute. Findings showed that there was only partial positive group effect on the attitudes of Group II participants' students toward the world of science; Group I showed no change at the close of the first year, but the second year study revealed a possible beginning of student attitude change. There was an apparent negative effect on participant attitudes immediately following the institute that was reversed during the following year of teaching. The professional self perception of all participants was markedly improved, but less success was noted in the ability of the participants to increase the maturity of their concerns about teaching. (DT)

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NATIONAL SCIENCE FOUNDATION SUMMER INSTITUTES AND THEIR INFLUENCE IN THE AFFECTIVE DOMAIN

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NATIONAL SCIENCE FOUNDATION SUMMER INSTITUTES AND THEIR INFLUENCE IN THE AFFECTIVE DOMAIN

The ultimate criterion of a teacher's effectiveness is usually considered to be his effect on his pupil's achievement of some educational goal defined in terms of desired pupil behavior, abilities, habits, or attitudes (Gage, 1963, p. 116). For the purpose of this study one aspect of effectiveness in a teacher is measured by his classroom behavior and the attitudes his students develop toward the world of science. The classroom behavior of a teacher is an integral part of student attitude formation. Any change in the way in which a teacher perceives himself in his role as a teacher or the subject he teaches will reflect itself in his classroom behavior and thereby in the perceptions of his students.

The purpose of this study is to determine whether a teacher's involvement in a Summer Institute Program (SI) designed to increase his content competencies will alter his perception of self and subject, and subsequently alter his student's view of science and education as a whole.

The Sample

The sample for this study was divided into two groups: Group I was composed of 48 teachers selected for participation in the SI of 1971 at The University of Texas at Austin and 1332 of their students; Group II contained 40 teachers involved in the SI of 1972 and 1029 of their students. At the close of the first year of teaching following the institute, 32 Group I teachers and 30 in Group II responded. Of the original sample, fourteen remained in school working toward advanced degrees, four no longer taught science, two suffered ill health, and six did not reply. At the time of the Group I second-year follow up study 26 teachers completed the measures. This results in differing sample numbers and scores for the Group I teachers between the first and second year study in the following results.

The Instruments

The Student Semantic Differential (SDS) contained 12 pairs of words selected to discover the Evaluation (Ev.), Potency (Po.), and Activity (Act.) factors described by Osgood (1957). The concepts, or protocols, to be rated were: Science Class, Science Laboratory, Science Teacher, and School. The participant's score was the class mean score of his students for each factor.

The Teacher Semantic Differential (TSD) contained nine protocols grouped into four categories descriptive of attitudes toward: Institutes, School situations over which teachers have little control, Teaching as a Job, and Self as a Science Teacher. The mean scores for each category were recorded as the participant's score.

The Annual Self-Inventory for Science Teachers (ASIST) was divided into seven sections containing statements that give operational meaning to the general characteristics of the professional science teacher as defined by NSTA (1970). Mean scores were recorded for statements in each section and for the total score for each participant.

The Teacher Concern Statement (TCS) was a listing of the things about teaching that concerned the person. These were scored from Non-teaching concerns at Level 0 to Student-centered concerns at Level 6. The mean level of all concerns listed was the participant's TCS score.

Testing

All four measures were taken in April of the teaching year prior to the institute, of the first year of teaching following the institute, and, for the 1971 SI teachers, of the second year following the institute. The TSD and TCS were administered at the close of both institutes.

Each participant selected a "typical" class for inclusion in the study and was asked to use a comprable class for the post-treatment measuresm however, the investigator had no control over the students selected.

The research design used in this study is identified by Campbell and Stanley (1970) as One-group-Pretest-Posttest. The .05 level of significance was chosen to test the hypotheses formed for acceptance.

Results and Findings

Null hypotheses were formed regarding change in student attitudes following their teacher's involvement in a SI retraining program. Data for Groups I and II were tested for change (Table 1).

Examination of Table 1 indicates that the students tested differed in their attitudes toward the world of science before and after their teacher's involvement in the SI in the following ways:

Table 1

CHANGE IN STUDENT ATTITUDES THROUGH TWO TRIALS (SSD)
(one-group-two-trials analysis of variance)

Protocol Range 0-28	Factor	Group	Trial 1 Group Mean	Trial 2 Group Mean	Groups by Trials F Ratio	Probability
Science Class	Ev.	I	20.2341	20.6752	.305	.5895
		II	19.6390	20.3148	2.658	.1106
	Po.	I	18.5712	17.7777	3.266	.0720
		II	16.8467	18.0887	9.438	.0049**
	Act.	I	17.9005	18.4032	.884	.3531
		II	17.8344	18.4616	3.284	.0773
Science Laboratory	Ev.	I	20.3882	20.5615	.003	.9558
		II	19.8012	21.1516	6.606	.0150**
	Po.	I	17.0818	17.3032	.282	.6035
		II	16.8483	17.8590	10.737	.0031**
	Act.	I	18.4325	18.7080	.037	.8393
		II	18.0141	18.9387	6.299	.0172**
Science Teacher	Ev.	I	22.5987	22.5787	.000	.9943
		II	21.2393	21.8851	1.363	.2517
	Po.	I	18.5745	18.2536	.286	.6025
		II	17.5886	18.6841	6.939	.0130**
	Act.	I	19.5789	19.5689	.001	.9778
		II	19.0878	19.6381	1.779	.1903
School	Ev.	I	18.2345	18.6589	.474	.5006
		II	17.5632	18.2004	.996	.3278
	Po.	I	19.1476	19.5745	.790	.3813
		II	19.0030	19.3685	.451	.5142
	Act.	I	17.9896	18.2771	.451	.5142
		II	17.4732	18.3939	3.880	.0499*

* sig. .05
** sig. .01

Group I (SI '71) N = 32
Group II (SI '72) N = 30

Students of Group II teachers felt their science class was more powerful ($p = .0049$); the science laboratory was more worthwhile ($p = .0150$), more powerful ($p = .0031$), and they felt more actively involved with it ($p = .0172$); the science teacher was perceived to be stronger ($p = .0130$), and they felt themselves more actively involved with school ($p = .0499$).

Data from teachers involved in the Group I follow-up study were compared and the results are given on Table 2. The data revealed that the students of teachers in Group I found their science laboratory to be more worthwhile and valuable by the close of the second post-institute year of teaching than had students of these teachers before their institute involvement ($p = .013$).

Table 2

GROUP I CHANGE IN STUDENT ATTITUDES THROUGH THREE TRIALS (SSD)
(one-group-three-trials analysis of variance)

Protocol	Factor	Trial 1 Group Mean	Trial 2 Group Mean	Trial 3 Group Mean	F Ratio	Probability
Science Class	Ev.	20.7501	20.8681	21.5535	.968	.3887
	Po.	18.6690	17.9102	18.1918	.995	.3788
	Act.	18.1418	18.6293	18.8544	1.270	.2893
Science Laboratory	Ev.	20.6655	20.2466	22.2265	4.714	.0132*
	Po.	17.2056	17.5167	17.9621	2.077	.1330
	Act.	18.7035	18.5710	19.3852	2.044	.1383
Science Teacher	Ev.	23.1580	22.7915	23.0994	.205	.8171
	Po.	18.9626	18.3621	18.9021	1.399	.2554
	Act.	19.8554	19.5716	19.9487	.406	.6748
School	Ev.	18.3361	18.7795	19.4462	.876	.4355
	Po.	19.1618	19.7306	19.9431	1.673	.1925
	Act.	18.1789	18.3345	18.9180	1.209	.3069

* sig. .05 Group I (2 Year Study) N = 26

Null hypotheses were formed regarding change in teacher attitudes following institute involvement. Data for both groups were compared between Trials 1 and 2 and Trials 1 and 3, results are given on Table 3.

This table reveals that there was a post-institute drop in certain aspects of teacher attitudes that were partially re-established during the following year. The following changes were noted:

Teachers regarded their institute experience as less valuable (Group I p = .010, Group II p = .001) and less powerful (Group I .051, Group II p = .001), and felt less actively involved (Group II p = .001) immediately after the institute. A year later they viewed it as more worthwhile (Group I p = .015) and their involvement with it as more active (Group I p = .004) than they had originally anticipated.

Teachers regarded the school conditions over which they had little control as less important (Group I p=.031, Group II p = .001) and less powerful (Group II p = .009) to their success in teaching after their institute experience.

Teaching as a job was felt to be less worthwhile (Group II p = .001), powerful (group II p = .001) and actively involving (Group II p = .001) after the institute involvement.

Teachers lost some sense of worthiness (Group I p = .007, Group II p = .001), power (Group I p = .031, Group II p = .001) in themselves as science teachers and less actively involved in teaching (Group II p = . 001) at the close of the institute, yet one year later all returned fullfold (Group I p = .045; Group I p = .048; Group II p = .047).

Table 3

CHANGE IN TEACHER ATTITUDES THROUGH TWO TRIALS (TSD)
(one-group-two-trials analysis of variance)

Protocol	Group	Trial 1 Group Mean	Trial 2 Group Mean	Trial 3 Group Mean	Trial 1-2 F Ratio	Trial 1-3 F Ratio
Institute (Range 4-28)						
Ev.	I	24.6562	23.7187	25.8750	7.512**	5.906**
	II	25.6552	16.7586	23.7241	271.531***	3.535
Po.	I	20.5937	18.8750	20.4375	4.307*	3.833*
	II	21.0000	16.2759	20.0345	50.089***	.673
Act.	I	22.3750	21.5625	22.9375	4.418*	4.695*
	II	22.4138	17.5172	23.6552	36.824***	.458
School Situation (Range 12-84)						
Ev.	I	54.5313	51.6562	54.4687	5.626*	.098
	II	57.9655	48.0347	54.9310	15.521***	.977
Po.	I	53.6875	54.6562	55.4375	.252	1.580
	II	57.1378	53.0698	60.9310	6.923**	.708
Act.	I	51.6562	52.5625	53.1250	.603	.671
	II	56.2414	51.9655	58.8966	3.483	1.138
Teaching as a Job (Range 12-84)						
Ev.	I	73.1250	72.5312	73.4687	.373	.010
	II	70.8966	50.5862	70.6552	145.363***	.007
Po.	I	65.9687	64.3437	65.2812	3.978	.746
	II	61.7241	52.5517	68.0698	21.509***	1.5222
Act.	I	69.2800	68.1600	70.0400	.413	.177
	II	66.7931	51.5517	70.3103	50.471***	2.813
Self as a Science Teacher (Range 8-56)						
Ev.	I	46.3750	43.5213	46.2812	7.653**	5.008*
	II	46.5862	32.9655	45.3448	167.601***	.393
Po.	I	42.0625	40.0312	42.1562	2.994*	3.877*
	II	42.2414	36.4828	43.1034	20.503***	.246
Act.	I	42.8750	41.5000	42.8750	.703	.001
	II	43.1724	33.5172	47.3793	68.781***	2.381

* sig. .05
** sig. .01
***sig. .001

Group I (SI '71) N = 32
Group II (SI '72) N = 40

Data for the Group I teachers in the second year follow-up study (Table 4) reveal that by the close of the second year after the institute, the teachers viewed their involvement as more valuable ($p = .008$), less awesome ($p = .010$), and themselves as more actively involved ($p = .02$) than they had before the institute.

Table 4

GROUP I CHANGE IN TEACHER ATTITUDES THROUGH FOUR TRIALS (TSD)
(one-group-four-trials analysis of variance)

Protocol	Trial 1 Group Mean	Trial 2 Group Mean	Trial 3 Group Mean	Trial 4 Group Mean	Groups by Trials F Ratio
Institute (Range 4-28)					
Ev.	25.0000	23.6400	26.1200	25.5200	3.489**
Po.	21.1600	18.6800	20.8600	20.8800	3.899**
Act.	23.0000	21.2000	23.0400	23.0000	2.605*
School Situation (Range 12-84)					
Ev.	55.0800	51.1200	54.4000	51.2000	1.878
Po.	54.7200	55.6400	56.6800	55.6400	.322
Act.	52.5600	52.6800	54.4000	52.4000	.393
Teaching as a Job (range 12-84)					
Ev.	73.8400	73.0400	73.7200	71.2800	.820
Po.	67.4000	64.7200	66.0000	65.4800	.950
Act.	69.2800	68.1600	70.0400	67.0400	.748
Self as a Science Teacher (Range 8-56)					
Ev.	46.3200	43.2000	46.5600	45.3600	2.279
Po.	42.0800	39.8800	42.0000	42.2800	1.662
Act.	43.0000	41.6000	42.9600	43.2400	.492

* sig. .05
**sig. .01

Group I (2 year study) N = 26

Null hypotheses were formed regarding change in participants' self-evaluation of themselves as professional science teachers. Data for both groups were compared between Trials 1 and 2, (Table 5).

This table reveals that at the close of the first year of teaching following the institute, teachers' professional perceptions of themselves had changed by improvement in the following ways:

> They felt they were better educated in science and the liberal arts (Group I $p = .0001$, Group II $p = .002$), had a more functional philosophy of education and more technical skills of teaching (Group II $p = .046$), had continued to grow in knowledge and skills (Group I $p = .006$, Group II $p = .003$), had insisted more on a sound educational environment in which to work (Group I $p = .001$, Group II $p = .001$), had done more to maintain their professional satats (Group I $p = .021$, Group II $p = .047$), had contributed more to improvement of science teaching (Group I $p = .003$, Group II $p = .032$), had taken a more vital interest in the quality of future science teachers (Group I $p = .004$, Group II $p = .032$), and in general beheld themselves as more professional persons (Group I $p = .0005$, Group II $p = .0007$).

Table 5

CHANGE IN TEACHER SELF-EVALUATION THROUGH TWO AND THREE TRIALS (ASIST)
(one-group-two/three-trials analysis of variance)

ASIST + Subscale Range 0-4	Group	Trial 1 Group Mean	Trial 2 Group Mean	Trial 3 Group Mean	Trial 1-2 F Ratio	Trial 1-2-3 F Ratio
A.	I	1.8931	3.6472		26.420***	
	II	2.2048	2.5938		12.083**	
	III	1.8496	2.5715	2.5346		14.648***
B.	I	2.8098	3.0811		2.386	
	II	2.9886	3.2010		4.234*	
	III	2.7692	2.9900	2.5346		5.783**
C.	I	2.1781	2.7144		8.486**	
	II	2.5514	2.8834		10.287**	
	III	2.0377	2.6935	2.9031		7.354***
D.	I	2.5662	3.0753		12.557***	
	II	2.9341	3.1114		2.420	
	III	2.5312	3.0442	2.9504		7.657**
E.	I	1.9459	2.8312		5.082*	
	II	2.1655	2.3934		2.359	
	III	1.9796	2.3115	2.2254		2.227
F.	I	1.5809	2.8312		10.577**	
	II	1.7669	2.3500		15.870***	
	III	1.4785	2.0823	3.5973		6.128**
G.	I	1.2572	2.1706		17.786***	
	II	1.9724	2.4076		4.945*	
	III	1.3281	2.1319	2.1215		8.411***
Total	I	2.0250	2.6116		16.978***	
	II	2.3817	2.7000		15.876***	
	III	1.9738	2.5758	2.5358		8.977***

+THE PROFESSIONAL SCIENCE TEACHER:

A. is well educated in science and the liberal arts.
B. posesses a functional philosophy of education and the technical skills of teac hing.
C. continues to grow in knowledge and skill during his career.
D. insists on a sound educational environment in which to work.
E. maintains his professional status.
F. contributes to the improvement of science teaching.
G. takes a vital interest in the quality of future science teachers.

* sig. .05
** sig. .01
***sig. .001

Group I (SI '71)
N = 32

Group II (SI '72)
N = 30

Group III (SI '71-2 year study)
N = 26

The teachers in the second year study (Group III, Table 5) at the close of the second year of teaching following the institute felt their perceptions of themselves as professional persons had further improved in that they:

> were better educated in science and the liberal arts ($p = .0001$), had a more functional philosophy of education and had more technical skills of teaching ($p = .0058$), had continued to grow in knowledge and skills ($p = .0010$), showed a greater interest in a sound educational environment in which to work ($p = .0016$), had had contributed more to the improvement of science teaching ($p = .0013$), had taken a more vital interest in the quality of future science teachers ($p = .0010$), in all, they rated themsleves as more professional persons ($p = .0007$).

Null hypotheses were formed regarding change in the maturity of teachers' concerns about teaching. Data for both groups were compared between Trials (Table 6).

Table 6

CHANGES IN LEVEL OF TEACHER CONCERN THROUGH THREE AND FOUR TRIALS (TCS)
(one-group-three/four-trials analysis of variance)

TCS Measure Range 0-6	Group	Trial 1 Group Mean	Trial 2 Group Mean	Trial 3 Group Mean	Trial 4 Group Mean	Groups by Trials F Ratio
Mean	I	4.2937	4.6911	4.8344		4.215*
	II	4.5310	4.5828	3.9655		2.931
	III	4.3538	4.7923	4.7308	3.8428	4.750**
Mode	I	4.4063	4.9357	5.0938		6.636**
	II	4.5517	4.6552	4.0000		2.873
	III	4.4231	5.0000	5.0000	3.9231	6.027**
Most	I	4.4326	4.6874	4.8790		4.166
	II	4.6207	4.8276	4.1379		2.605
	III	4.3077	4.6923	4.7300	4.0385	2.214

* sig. .05
**sig. .01

Group I (SI '71) N = 32
Group II (SI '72) N = 30
Group III (SI '71-2 year study) N = 26

At the close of the first year of teaching following the institute the level of the teachers' concerns about teaching had changed in that:

> The mean level of the teachers' concerns was more student-oriented (Group I $p = .049$) and the level of their most frequently listed concern was more mature (Group I $p = .008$).

At the close of the second year of teaching following the institute teachers in the Group I follow-up study had changed as follows:

Teachers showed additional maturity in the mean level of their concerns ($p = .004$) and their most frequently listed concern was more student-oriented ($p = .001$).

Conclusions

The findings indicate that there was only partial positive group effect on the attitudes of Group II participant's students toward the world of science. Group I showed no change at the close of the first year, but the second year study revealed a possible beginning of student attitude change. The changes found in this study were not as great as those found by Butts and Raun (1969), Ost (1971), ~~Ryans (1963)~~, or Yager (1966) who reported on institutes specially structured to achieve attitude change. Both institutes in this study were designed to improve teacher content competencies as a means of increasing teaching effectiveness with no attention given to the affective domain.

There was an apparant negative effect on participant attitudes immediately following the institute that was reversed during the following year of teaching. This suggests that teachers came to the institute with high expectations; yet, after nine weeks of intensive work, they apparantly experienced a let-down of feeling at the close of the institute that was replaced by a return to "normal" by the close of the following year. This was accompanied by an increasing respect for the value of the institute itself once participants had had the opportunity to employ the competencies, skills, and techniques acquired during the institute. These results point out that in many instances, short term measurement, such as end-of-the-institute, does not accurately reflect the real effect on subsequent attitudes.

The professional self perception of all participants was markedly improved. The teachers' evaluation of themselves as professional science teachers improved significantly by the close of the institute and continued to grow during the following years of teaching.

Less success was noted in the ability of the participants to increase the maturity of their concerns about teaching. Teachers in 1971 were found to be more mature at the close of the institute and continued to increase in maturity during the following years. Teachers in the '72 SI failed to show maturation due primarily to the inclusion of an increasing number of 0 level concerns dealing with job security for the 1973 teaching year, a time when the number of surplus teachers was increasing.

The lack of definite positive attitude change may have been influenced by several factors. There was no control over the comprability of students selected by participants for inclusion in this study and the degree of confidence established with the student groups prior to measurement is unknown. Teachers who applied for and were accepted as participants would be expected to come to the institute with pre-existing high positive attitudes and concerns that would be difficult to increase. Finally, the early 1970s were a time of foment and uncertainty in the world of education for both students and teachers that would surely be reflected in their attitudes.

This study stresses the need for further long range studies in the affective domain in order to uncover changes not exposed in short term measurements. It is indicated that certain aspects of this domain may be positively altered by such institute involvement.

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